Tech 1.5

Adapting digital development solutions for a +1.5°C world

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Vodafone Foundation

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Table of Contents

Foreword 3
Executive summary 4
Methodology 6
Survey data 7
The climate emergency, development and technology 8
- How the climate emergency impacts health, education, and disaster resilience 9
- Digital tools in global development and climate adaptation 10

Key findings 12
- Challenge 1: Expanding inclusive and resilient infrastructure 13
- Challenge 2: Designing climate-resilient solutions that respond to local needs 21
- Challenge 3: Empowering through skills and locally relevant solutions 27
- Challenge 4: Fostering collaboration and innovation to strengthen digital development 31

Blueprint for action 39
Conclusion 45
List of abbreviations 46
Acknowledgements 47

Foreword

Digital technology is reshaping lives. But rapid climate change is rewriting the rules. Record heat, floods and storms are no longer outliers – they are our new operating environment. And they're hitting the same systems we rely on to deliver learning, health and emergency response.

This report makes the reality plain: 88% of development professionals have already seen digital solutions falter because of climate disruptions, and 69% expect implementation to get harder soon. The message is clear. If we want digital to keep driving equitable progress, we must build for a +1.5°C world – now.

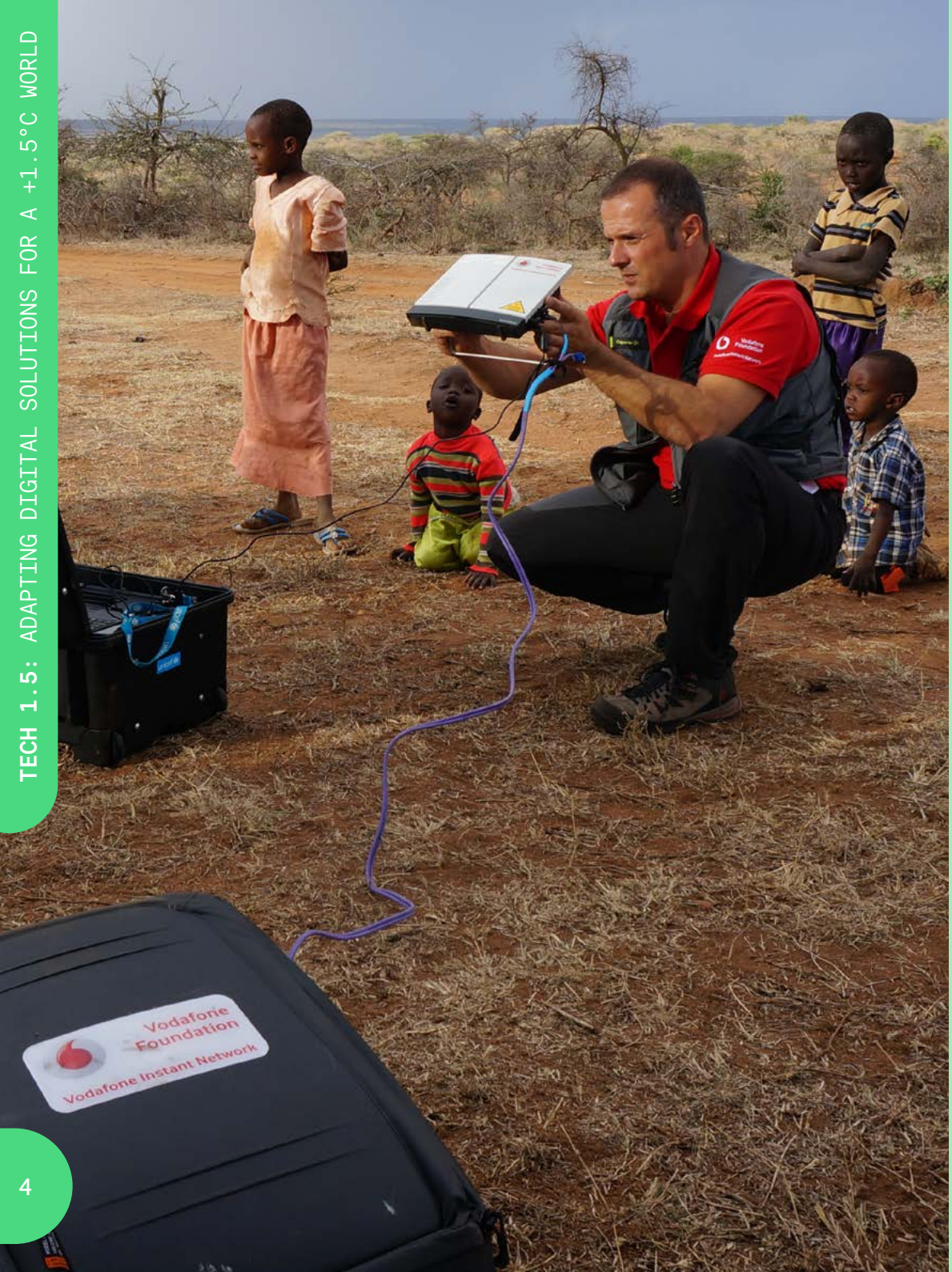
At Vodafone Foundation, we are already adapting. We've upgraded Instant Network Schools to perform in higher temperatures with lower power requirements. We've expanded our Instant Network Emergency Response hubs to get people connected faster when disasters strike. But isolated fixes are not enough.

Together with Devex, and guided by leading experts, we offer this report as both a reality check and a route map. Drawing on insights from over 1,100 professionals, the Tech 1.5 Blueprint sets out four nonnegotiables: invest in resilient inclusive infrastructure; design tools that work offline and on low energy; build skills and local ownership; and unlock radical collaboration and finance at scale.

This is a call to partner with urgency and purpose. To coinvest in open, interoperable systems. To put communities at the centre of design. And to back solutions that can withstand heat, floods, outages and displacement, so services don't fail when people need them most.

The importance of digital solutions in an ever more volatile world will only increase. Only by working together can we ensure digital technology delivers for every community, in every crisis, for generations to come.

Lisa Felton
Managing Director, Vodafone Foundation



Executive summary

The climate crisis is profoundly reshaping the global development landscape. Temperatures exceeding the 1.5 degrees Celsius global warming limit, intensifying disasters, and shifting weather patterns are increasingly undermining progress toward the Sustainable Development Goals, or SDGs. These disruptions are keenly observed in the health, education and disaster resilience sectors as they drive hundreds of thousands of additional deaths from heat, pollution, and disease; derail learning outcomes through school closures; and displace record amounts of climate-vulnerable populations from their homes.

Digital tools — from mobile platforms and e-learning systems to artificial intelligence-driven early warning and diagnostics — have been transformative in efforts to meet development targets, expanding access to schools and clinics, supporting disaster preparedness, and creating opportunities for adaptation. Yet, these tools are increasingly constrained by the same climate shocks they aim to mitigate, such as damaged infrastructure and connectivity breakdown, leading to disrupted service delivery.

This report, produced by Devex in partnership with the Vodafone Foundation, draws on a global survey of development professionals and expert insights to explore how digital development efforts can adapt to rapidly changing climate conditions. It reveals four critical challenges to be addressed for digital tools to deliver climate-resilient impact in the health, education, and disaster resilience sectors:

Infrastructure gaps: Persistent weaknesses in digital and basic infrastructure leave vulnerable regions and communities exposed to climate shocks.

Design shortcomings: Many tools are not adapted to local realities, limiting usability, uptake, and resilience.

Limited skills and participation: A lack of digital literacy, particularly among women, youth, and marginalized communities, constrains the adoption and cocreation of solutions.

Fragmented collaboration: Weak coordination among governments, donors, private sector players, and local communities slows innovation and scaling.



The research shows that while 95% of experts agree that digital tools help mitigate climate impacts, only a fifth believe current solutions are well-adapted to prevent or reduce climate risks in health, education, and disaster resilience. Meanwhile, 9 out of 10 respondents call for greater investment in climate-resilient digital technologies, and 81% highlight the urgent need for stronger collaboration.

To meet these challenges, the report presents a **blueprint for action** that calls for global development stakeholders to:

Invest in resilient, inclusive infrastructure that can withstand climate shocks.

Design fit-for-purpose solutions with features such as offline functionality, low energy use, and localized adaptability.

Build digital skills and literacy to empower communities as co-creators and long-term stewards of technology.

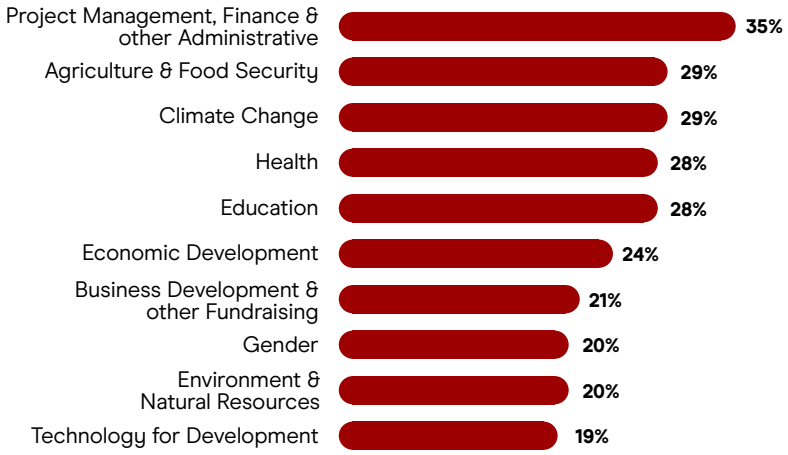
Strengthen collaboration and financing models to unlock cross-sector partnerships and scale innovation.

The path forward demands a shift from siloed digital interventions to climate-smart digital ecosystems that are inclusive, resilient, and community-driven. With the right investments, design choices, and partnerships, digital tools can serve not only as accelerators of development but as critical enablers of climate adaptation, helping secure a more equitable and sustainable future.

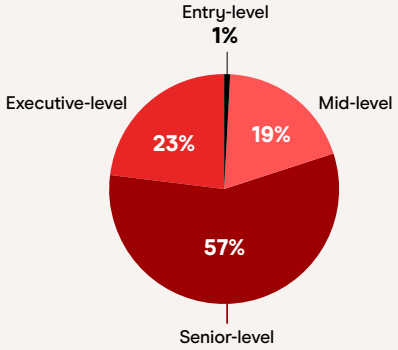
Methodology

To inform this report, Devex conducted an online survey from **Feb. 24 to May 16, 2025**. The survey was sent to Devex's network of international development professionals with experience working in health, education, disaster resilience, and climate change, representing public institutions, development organizations and the private sector. A total of 1,132 respondents answered the online survey.

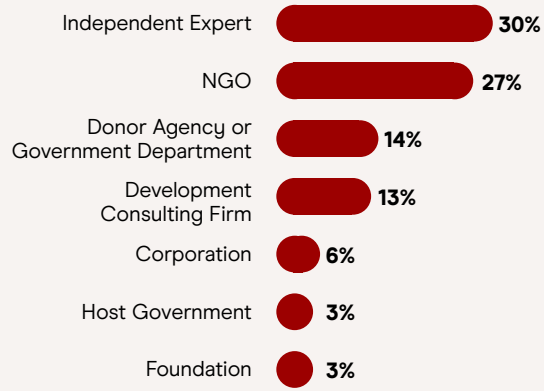
Which sectors have they worked in?



What position do they hold at their organizations?



Where have they worked?

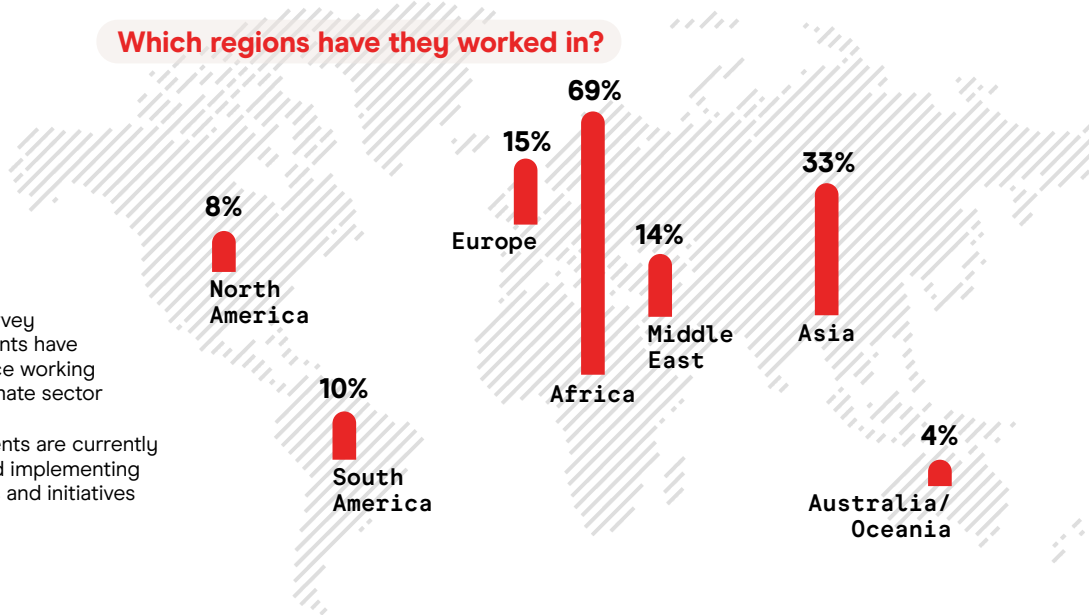




90% of the survey respondents have experience working in the climate sector

71% of the survey respondents are currently involved in planning and implementing development programs and initiatives

Which regions have they worked in?



To further support the survey findings, Devex conducted in-depth interviews with 12 experts engaged in digital development programs between May 20 and June 9, 2025.

Devex and the Vodafone Foundation also organized two high-level roundtable discussions to explore how digital tools can better adapt to the realities of a changing climate. These roundtables brought together leaders and experts across sectors to discuss how digital solutions can strengthen service delivery in climate-vulnerable communities and to identify key barriers and opportunities for scaling impact.

Find out more about our participants in the acknowledgements section.

Survey Data

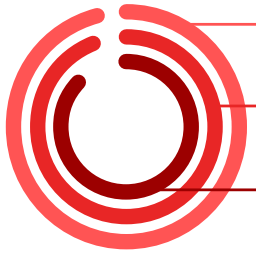
84% of respondents report their organization uses digital solutions for development programs

88% observed a decline in the effectiveness of digital solutions due to climate-related factors

69% anticipate added difficulties in implementing digital programs due to worsening climate conditions

51% agree that climate change reduces the effectiveness and sustainability of digital programs

Perceived negative impact of climate change on development outcomes



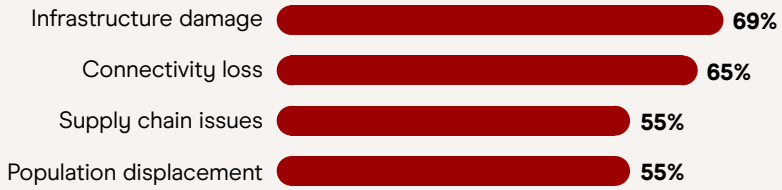
96% Disaster resilience

94% Health

87% Education

96% of respondents believe that climate change negatively impacts disaster resilience

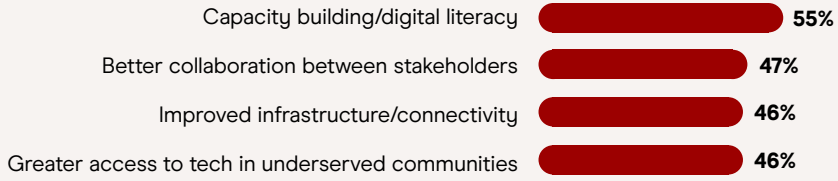
Top climate-related factors affecting digital programs



81% believe there is a lack of collaboration among global development partners to adapt digital technologies to climate change.

90% believe global development funders need to invest more in digital technologies for climate adaptation

Top enablers for effective climate adaptation of digital tools



Perceptions of digital tools' adaptation to climate resilience

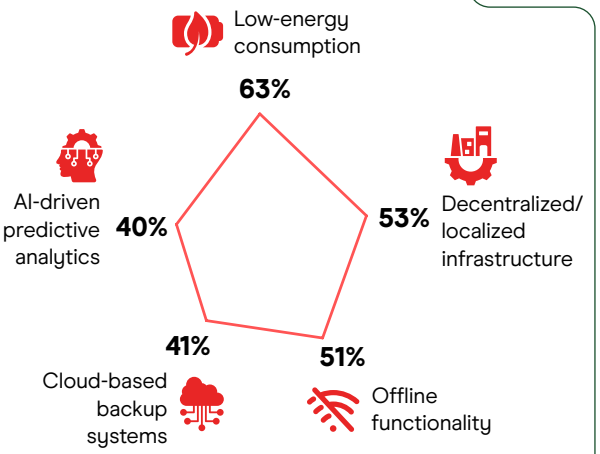


95% agree digital technologies help development programs withstand climate effects

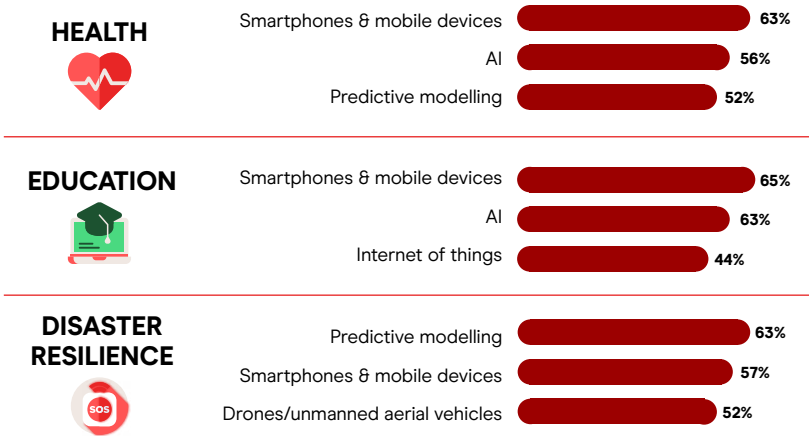
55% believe digital technologies are adequately adapted for climate resilience

20% believe digital tools are well adapted and used to minimize/prevent climate impacts in health, education, and disaster resilience

Top technological features for climate-resilient digital solution



Top digital technologies for mitigating climate impacts



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The climate emergency, development, and technology

Climate change is having a profound impact on communities around the world, with worsening conditions and weather shocks — including extreme temperatures, unseasonal rain patterns, and intense hurricanes and storm surges — impacting both rural and urban populations. While efforts have been made to prevent average temperatures from exceeding the 1.5°C global warming limit, more needs to be done to meet long-term climate goals. And while climate change has the ability to undermine nearly all development goals, addressing the climate crisis also offers opportunities to accelerate progress toward achieving them.

Digital technology in particular is seen as both a powerful tool for combating climate change and advancing the SDGs through their wide range of applications and adaptability. However, concerns have emerged around the effectiveness of digitally driven development programs in the face of worsening climate conditions. What challenges and opportunities shape the resilience of digitally driven programs amid growing climate threats? And what roles should development players play in removing barriers and harnessing the full potential of these programs to reach and benefit those who need them most?

In partnership with the Vodafone Foundation, Devex surveyed over a thousand international development professionals working in health, education, and disaster resilience to understand how climate change is affecting digitally driven programs in their sectors. These findings were complemented by in-depth interviews and roundtable discussions with experts, global executives and program implementers working in the digital space to address the effects of climate change.

How the climate emergency impacts health, education and disaster resilience

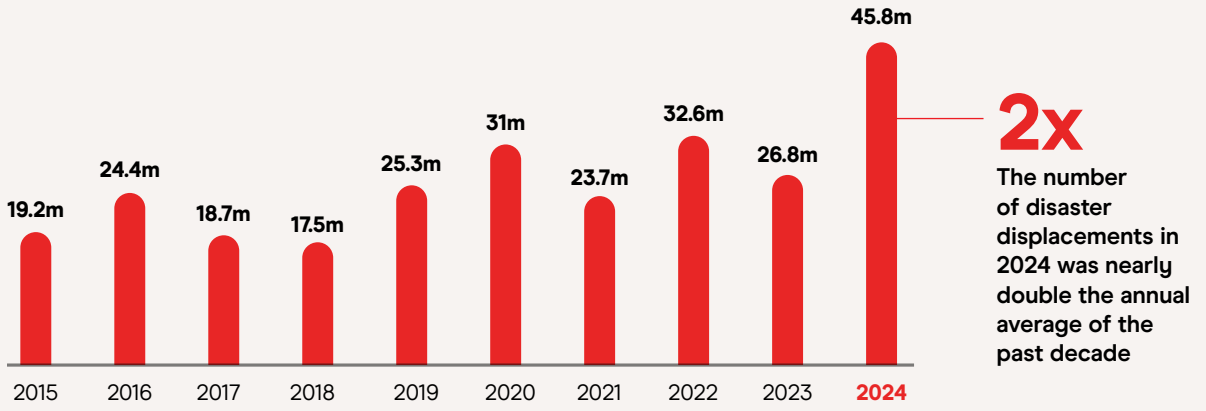
Global development stakeholders are grappling with ever-growing challenges driven by climate change. In the health sector, the World Health Organization has, as early as 2015, declared climate change as the greatest threat to global health in the 21st century. Climate change is set to cause an estimated 250,000 additional deaths per year from malnutrition, malaria, diarrhea, and heat stress alone between 2030 and 2050. Climate hazards such as extreme heat also heighten the risk of developing complications that lead to maternal and neonatal morbidity.

Air pollution is similarly projected to worsen due to the established relationship between climate change and air quality, as shifting climate patterns and wildfires caused by warmer temperatures amplify air pollutant levels. Today, air pollution is the second-leading risk factor for death in terms of total population and among children under 5 years old.

In the education sector, the World Bank notes that climate shocks have the ability to erode service delivery, destroy infrastructure, and prolong school closures, such as when schools are repurposed as emergency centers. The United Nations Children's Fund, or UNICEF, reported that nearly 250 million children had their schooling disrupted by climate crises in 2024, creating a vicious cycle where a lack of access to education puts individuals at higher risk to future shocks.

In the disaster resilience and response sector, internal displacement is reaching new highs. According to the latest Global Report on Internal Displacement, there was a record-breaking 46 million internal displacements due to disasters in 2024 — nearly double the annual average over the past decade. Of this figure, 25 million displacements were attributed to storms, while 19 million were caused by floods.

Internal displacements by disasters in millions



2x

The number of disaster displacements in 2024 was nearly double the annual average of the past decade

Source: IDMC





Photo: Dibakar Roy / Unsplash

Digital tools in global development and climate adaptation

Recent years have seen global development players increasingly utilize digital tools to expand access to essential services. Platforms for e-learning and e-health have created new avenues for delivering crucial services remotely, reducing the need to physically travel to schools or hospitals during extreme climate events. From smartphones to AI, digital tools have similarly become integral to disaster response, minimizing casualties and damage during emergencies. Yet despite their widespread use, evidence shows that more needs to be done to maximize their impact and to safeguard progress against climate shocks.

Devex survey data reveals that 84% of respondents use digital solutions for development programs. However, as climate-related disruptions increase, 88% have seen the effectiveness of digital tools decline. Half believe climate change is undermining the sustainability of these programs, and 69% expect implementation to become even more difficult in the near future. Nearly all respondents believe that climate change negatively impacts development outcomes in disaster resilience (96%), health (94%), and education (87%).

The survey also identified challenges and opportunities in key areas related to the climate resilience of digital development tools:

- Infrastructure damage (69%) and connectivity loss (65%) are identified as the top climate-related threats to digital programs, while smartphones, AI, and predictive modelling are seen as the most effective technologies for mitigating these impacts, especially when designed with features such as low energy use, offline functionality, and localized infrastructure.
- Only 55% of respondents believe current tools are adequately adapted to increase the climate resilience of development programs, while just 20% say they are well adapted and used in health, education, and disaster resilience specifically to prevent or reduce climate impacts.
- Increased digital literacy and capacity building (55%) is considered the top enabler for the effective adaptation of digital tools, while other respondents mention the need for better collaboration (47%), improved infrastructure (46%), and greater access to technology (46%).
- Finally, 81% believe there's a lack of collaboration among development groups, and 90% urge greater investment in climate-resilient digital technologies.

Types of climate risks affecting digital tools

The climate crisis presents both immediate and long-term risks to the deployment and function of digital tools and technology, from extreme weather events to chronic weather conditions.

Short-term extreme events disrupt the use of digital tools by undermining the performance of the tools themselves or by damaging critical infrastructure such as telephone poles, servers, and energy sources.

Long-term effects of climate change may not give rise to an immediate catastrophic failure but have a more indirect impact that can degrade the performance of the service or system. Examples of disruption include:

- Disruption due to frequent maintenance of key infrastructure
- Disruption due to frequent device failure
- Supply chain disruption due to faster turnover of equipment

These factors need to be taken into account to ensure that digital tools remain effective in the face of climate-related threats.

Source: Resilient pathways: the adaptation of the ICT sector to climate change



Photo: Carl Kho / Unsplash

The implications for digitally driven development programs are clear: As the climate crisis intensifies, digital tools must also adapt to meet the complex and growing needs of climate-vulnerable communities. The rising frequency and scale of climate disruptions — from disasters to resource scarcity — demand adaptable, inclusive digital solutions that not only advance the SDGs but also bolster resilience in the sectors most affected by climate change. Digital solutions must be optimized to meet these challenges, and communities must be equipped with the right tools and knowledge to bridge the digital divide and access these solutions.

Investing in digital technologies could accelerate SDG targets by 70%, and layering AI on top could raise that to 80%. That's what excites me, because digital tools can truly help make the world a better place. Of course, there are barriers: infrastructure gaps, device affordability, cybersecurity, digital skills, and ensuring content is relevant and accessible.

Roundtable participant



Key findings

Against the backdrop of increasing climate disruption, digital development solutions must incorporate thoughtful design and adapt to withstand increasingly extreme climate conditions. But what is needed to make these tools truly resilient? What barriers stand in the way of effective deployment, and what kinds of opportunities are available to overcome them?

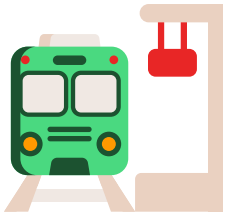
The research found that persistent infrastructure gaps, design shortcomings and lack of community relevance, limited local digital skills, and fragmented coordination and deployment hold back digital development technologies, which are further exacerbated by climate-related disruptions. But within these issues are opportunities to strengthen the delivery of crucial health, education, and disaster response programs. This section explores these four key challenges in depth and showcases how digital programs can address persistent gaps within communities and the broader digital development ecosystem.

Challenge 1: Expanding inclusive and resilient infrastructure

Reliable infrastructure allows digital tools and programs to deliver critical services such as telemedicine, remote learning, and early-warning systems, as well as creates the foundation for long-term resilience and broader inclusion in digital services. However, gaps in infrastructure persist in rural, remote, and disaster-prone regions where digital development programs are needed most. The rise in the frequency of extreme weather events also heightens the risk of infrastructure damage, leading to power outages and loss of connectivity that could render digital tools ineffective.

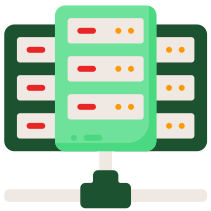


Types of infrastructure



Basic infrastructure refers to essential physical systems and services that support everyday life, including roads, bridges, railways, electricity, water supply, sanitation, and basic telecom connectivity. These systems are foundational to economic activity, public services, and social welfare.

Examples: Paved roads, public transit, power grids, clean water systems, sewerage facilities, and basic mobile/phone networks



Digital infrastructure refers to the technology systems and physical assets that enable the creation, storage, processing, transmission, and exchange of digital data.

Examples: Broadband networks (fiber, wireless, satellite, undersea cables), 4G/5G cells, smartphones, satellites, data centers, cloud infrastructure, internet of things, or IoT, and cybersecurity and regulatory frameworks

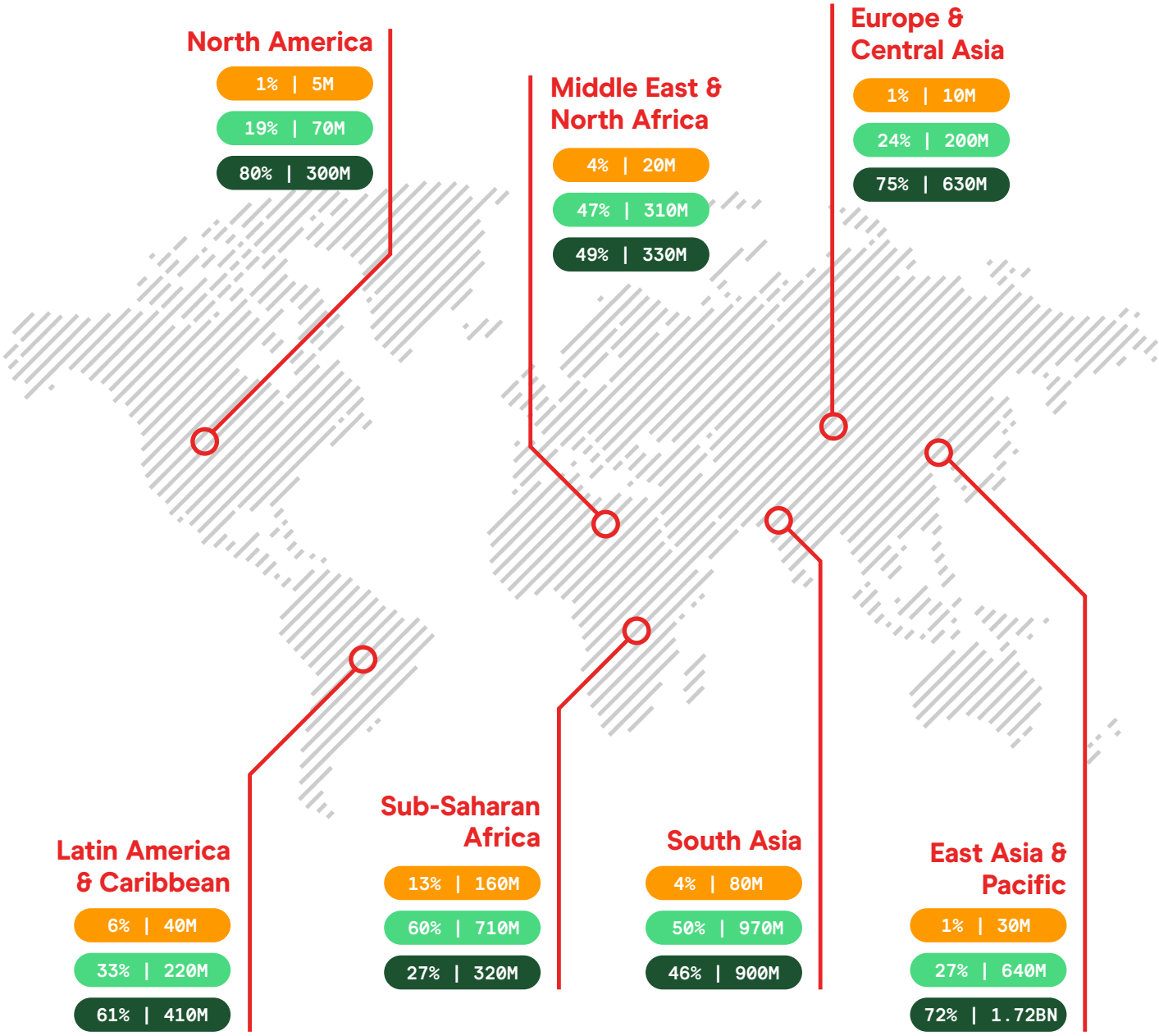
The International Telecommunication Union, or ITU, the United Nations specialized agency for digital technologies, estimates that closing the investment gap for digital infrastructure will require at least $1.6 trillion. The scale of this challenge is most evident in low- and middle-income countries, or LMICs, where 54% of the population remains offline.

According to GSMA's 2024 report on mobile internet connectivity, 4.6 billion people — 57% of the global population — now access mobile internet on their own devices. Yet 3.1 billion remain offline despite living in areas with coverage, and around 350 million still lack any access at all. Regional trends vary widely. In East Asia and the Pacific, mobile internet subscribers increased to 50 million in 2023, while mobile internet users in South Asia declined from 60 million to 50 million. Sub-Saharan Africa remains the most excluded region, driven by persistent challenges related to expanding mobile broadband coverage in rural areas and people's ability to afford devices.

Regional breakdown of the connectivity, usage gap and coverage gap estimates as of the end of 2023

GLOBAL

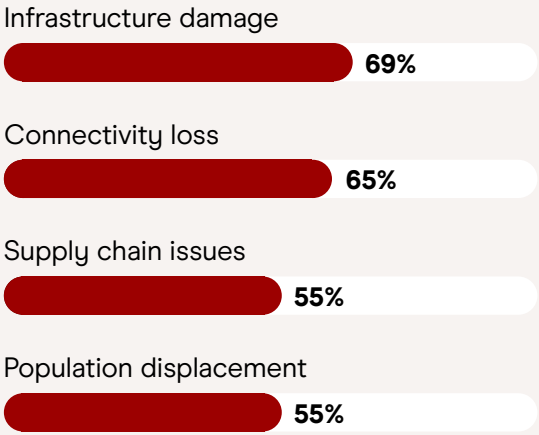
Coverage gap	Usage gap	Connected
4% | 350M	39% | 3.11BN	57% | 4.61BN



Source: GSMA

Devex survey data shows that 69% of respondents identify infrastructure damage as the top climate-related factor affecting digital programs, followed by connectivity loss. The 2022 floods in Pakistan demonstrate how these challenges are intrinsically linked, as widespread destruction to both basic and digital infrastructure led to major internet outages due to damaged fiber-optic networks. This underscores the need to strengthen digital infrastructure and connectivity as a foundation for maintaining the usability of digital tools and building the resilience of development programs in the face of extreme weather.

Top climate-related factors affecting digital programs



Source: Devex survey

One of the biggest impacts of climate change on digital development programs is the increased risk of disruption to digital infrastructure and the services it supports. Extreme weather events such as floods, droughts, or heat waves can damage power grids and data centers, making it difficult for digital programs to operate reliably, especially in regions already vulnerable to climate change. The physical infrastructure supporting these systems may become deprioritized as resources are redirected to address more immediate climate threats.

Felipe J Colón-González, Wellcome

Devex interviewees mention that partnerships between telecommunication companies and global development players are instrumental in closing these gaps. As Sarah Beardmore, head of the strategic partnerships and capabilities team at the Global Partnership for Education, or GPE, explains, "Addressing this digital divide is urgent, and telecommunications companies have a critical role to play." She highlights the "significant untapped potential to expand infrastructure and ensure universal connectivity, even in the most remote areas," in offering zero-rating educational platforms — wherein one can access learning resources without incurring data charges — and free Wi-Fi in underserved areas. However, challenges remain with the financing of digital infrastructure in sparsely populated and remote areas.

Beyond the role of telcos, closing the gap requires coordinated action from a range of players where government institutions and the private sector work hand in hand with global development groups and local communities to deepen the understanding of the most prevalent issues and pool resources in situations where the cost of developing infrastructure is prohibitive.


Photo: Dibakar Roy / Unsplash

CASE STUDY

Improving access to education through increased connectivity

Digital tools can act as transformative instruments by fostering inclusive learning. However, access to digital education remains uneven due to limited internet access among potential learners. Launched by UNICEF and ITU in 2019, Giga is a global initiative to connect every school to the internet and every young person to information, opportunity, and choice. Focused on public schools in underserved and remote areas, Giga helps governments identify coverage gaps, mobilize investment, and deliver sustainable digital infrastructure as a foundation for inclusive education.

A key element of the initiative's success is using open-source tools and machine learning to assess real-time connectivity, mapping over 2.2 million schools in 41 countries by 2024. Giga works closely with a range of partners to enhance school connectivity and access to digital learning resources. For example, UNICEF collaborates with organizations such as Kiwix, which provides offline access to educational content to help bridge last-mile gaps.

Giga is essentially mapping out which schools don't have internet. For us, it is interesting to know and to compare that data with where we are and see where there's room for expansion. Lots of schools have a measure of internet access, but what happens sometimes is that the internet is in the principal's office, not in the actual classrooms. Such mapping really helps us figure out where the learners' connectivity is still an issue.

Stéphane Coillet-Matillon, Kiwix



Photo: Giga

Giga's support has led to significant gains in affordability, planning, and access, particularly in LMICs:

- In Kyrgyzstan, school mapping enabled the government to cut internet costs by nearly half and save $200,000 annually.
- In Rwanda, Giga helped lower the cost per megabits per second, or Mbps, by up to 55% by attracting private investment in fixed wireless infrastructure.
- In Colombia and Niger, Giga used AI and satellite imagery to locate thousands of unmapped schools.

Through supporting community networks and employing a combination of satellite, microwave, and fiber options to suit varied contexts, Giga emphasizes its commitment to adaptive and resilient infrastructure. The initiative continues to innovate by piloting satellite connectivity in remote regions and exploring blended finance models and social impact instruments.



Investing in resilient digital infrastructure and reliable connectivity is also essential for expanding access to high-quality healthcare in LMICs. Where these systems are in place, the digital transformation of healthcare has proven to be a powerful driver of improved outcomes and system-wide efficiency. Web-based medical services such as telehealth and mobile health applications offer a convenient way for patients to access hospital records, book appointments, and receive remote monitoring services. However, these benefits are only possible when patients and medical practitioners have reliable internet access. When extreme climate conditions interrupt connectivity, the delivery of digital health services, including disaster-related health interventions, is significantly compromised, placing already vulnerable populations at greater risk.

Whether it's data analytics tools, IoT devices, or mobile apps, they all rely on digital infrastructure, which is increasingly vulnerable to climate change. In the Democratic Republic of Congo, floods have disrupted our investments, while in parts of Europe, extreme heat has melted fiber cables and compromised data center power systems. Once connectivity breaks down, all the software built on top of it stops functioning. Climate change is taking a serious toll on these systems, faster than anyone expected. Backup batteries fail under high temperatures, and flooding is occurring at levels we've never seen before. These events are severely damaging the very tools we rely on to deliver support.

Abhinav Sinha, British International Investment

Integrate climate-smart and green infrastructure

Infrastructure development requires thoughtful planning and execution. Many forms of digital infrastructure such as data centers, telecommunications equipment, and server networks are energy-intensive and vulnerable to power outages during extreme weather events. To mitigate these risks, developing digital infrastructure that is both climate-resilient and aligned with climate and development goals is crucial. For instance, using local renewable energy sources such as solar, wind, or hybrid microgrids can ensure stable power for digital systems while reducing emissions.

Greening digital infrastructure can help achieve energy savings in data centers through thoughtful design that incorporates energy-efficient technologies, optimized cooling systems, and efficient power distribution. For example, Microsoft is exploring new approaches to data-center design to reduce environmental impact and advance its commitment to become carbon-negative by 2030. Recent efforts include piloting low-carbon concrete mixtures using biogenic limestone and industrial byproducts, reducing embodied carbon — or the emissions generated in the entire lifecycle of a building material — by over 50% in some projects. The company has also secured long-term agreements for sustainable cement and is testing engineered timber to reduce reliance on steel and conventional concrete.

Extend connectivity where infrastructure is compromised

An inclusive and resilient approach to addressing infrastructure gaps complements building climate-resilient digital infrastructure with efforts to address the immediate reality that many regions still lack access to reliable internet or electricity. In these contexts, leveraging technologies that can adapt to internet or energy disruptions can help bridge the infrastructure and connectivity divides.



When we think about greening digital infrastructure, we want to ensure investments are resilient to severe weather and other related risks, and that facilities—especially data centers—are built to maximize energy efficiency. That's why we utilize international standards and good practices as part of our financing considerations.

Seth Ayers, World Bank

CASE STUDY

Empowering communities through localized digital education with Vodafone Foundation's Instant Network Schools

Launched in 2013 by the Vodafone Foundation in partnership with the U.N. refugee agency, UNHCR, the Instant Network Schools, or INS, program addresses critical infrastructure and connectivity challenges that limit access to quality education in refugee and host communities. The initiative transforms traditional classrooms into digitally connected learning environments, even in areas with limited electricity or internet access.

Each INS deployment includes a suite of digital and power infrastructure tailored for low-resource environments:

Connectivity: Classrooms are equipped with Wi-Fi routers connected via mobile networks or satellites to ensure reliable internet access.

Power: A solar panel and battery system ensures continuous electricity for devices, supported by a backup generator.

Hardware: The Instant Classroom kit includes a laptop for the teacher, 25 tablets for the students, a projector and speakers, an inbuilt charging station, and a local server.

In response to worsening climate conditions, Vodafone Foundation has developed a monitoring app designed to track internal device temperatures. The app feeds data to a central dashboard managed locally and triggers alerts if devices reach critical heat levels, preventing damage and safeguarding the school community. The foundation also established a refurbishment, disposal, and recycling process to ensure that damaged devices are either responsibly repaired, repurposed, or safely disposed of, reducing environmental impact while maintaining access to technology.

The initiative had established over 130 INS across six countries: Kenya, Tanzania, the Democratic Republic of Congo, South Sudan, Egypt, and Mozambique. The program has reached more than 378,000 students and trained nearly 7,000 teachers, producing measurable improvements in student motivation, academic outcomes, and teacher satisfaction.



For instance, satellite technology increasingly plays a role in boosting connectivity in regions where terrestrial networks are limited or disrupted. Low Earth orbit, or LEO, satellite constellations, led by SpaceX's Starlink, Amazon's Project Kuiper, Eutelsat OneWeb, AST SpaceMobile, and Telesat's Lightspeed. operate closer to Earth's surface, offering minimal lag and rapid deployment, making them valuable for remote and dispersed populations where fiber deployments are impractical or costly. However, their effectiveness relies on thoughtful integration that addresses their limitations, including the need for reliable energy infrastructure, which remain vulnerable to climate-related disruptions.

CASE STUDY

Strengthening early response through Humanity Insured's digitally enabled insurance model

In the wake of climate disasters, delays in financial assistance can deepen poverty and prolong recovery. Traditional insurance models often fail to reach the most vulnerable due to high costs and complex claims processes. As a result, climate-affected communities are left without timely support when extreme weather strikes.

Founded in 2024, Humanity Insured addresses this gap through satellite-enabled parametric insurance, which delivers faster, more equitable payouts based on objective climate data. The organization aims to expand access to innovative insurance solutions for climate-vulnerable communities, enabling key groups such as smallholder farmers, displaced populations, coastal communities, women-led enterprises, and urban informal workers to invest in resilient futures by removing financial barriers to insurance.

Humanity Insured's signature approach uses subsidized, satellite-triggered parametric insurance to deliver rapid payouts when climate thresholds such as drought, rainfall, or extreme heat are breached. Below are some examples of how innovative insurance builds resilience within communities.

- In Malawi, over £80,000 ($100,000) in drought-related payouts were disbursed in 2025 to more than 1,200 smallholder farmers. The scheme was co-funded with Tearfund and Global Parametrics.
- In India, Humanity Insured partners with the Mahila Housing Trust to support women working in the informal sector. Insurance coverage is triggered by extreme heat events, helping protect income and health in the face of rising climate volatility.



Photo: Humanity Insured

By linking payouts to real-time weather data and subsidizing costs for vulnerable groups, Humanity Insured shifts insurance from a reactive safety net to a proactive tool for building local resilience. The organization aims to scale to 30 million people and a £2 billion ($2.7 billion) payout capacity by 2030.

As climate disruptions intensify, the demand for reliable, inclusive, and sustainable infrastructure becomes more urgent. A climate-resilient approach to digital development programs considers the foundation for digital development solutions to be context-specific, supported by strong partnerships, and built for long-term adaptability.

Challenge 2: Designing climate-resilient digital tools that respond to local needs and climate threats

While digital technologies are widely recognized as powerful tools for climate adaptation, using these tools for development programs requires a deeper understanding of community challenges and the local environmental context. Programs that fail to take local issues into account risk low uptake and buy-in among targeted end users, ultimately missing opportunities to build long-term resilience and scalability. Assessing community needs and identifying key technological features that can withstand prevalent climate conditions and extreme weather events that commonly take place in the community allows implementers and their partners to design contextually relevant interventions and incorporate digital tools that are fit for purpose.

Our survey data shows that while 95% of respondents acknowledge that digital technologies help development programs withstand the effects of climate change, only 55% believe that digital technologies are adequately adapted to increase the climate resilience of development programs. In areas of health, education, and disaster resilience, only a fifth of respondents believe that digital tools are well adapted and used to minimize or prevent the impact of climate on development outcomes. Experts also note that a failure to design technological tools and solutions for the realities within the community will likely waste resources and render the technology unusable and potentially unsafe.



Incorporate climate-adaptive features into digital tools

Digital tools must be accessible and functional in the most challenging environments where internet access is unreliable, electricity is scarce, or infrastructure is damaged. This often involves prioritizing the development and deployment of technologies that can operate offline, use minimal energy, integrate with alternative power sources, and are engineered to function in extreme conditions with modular, repairable components. This allows for the continuity of services in climate-affected regions, be it for health, education, or emergency response.

If you go into hospitals in many LMICs, you'll often find a storage room full of equipment where you might see even the latest technologies that have failed. Why? Because they weren't designed for the reality on the ground. Power fluctuates, and when you lose electricity and it comes back, there's a massive surge. That damages the equipment. So the same old problems persist, but now they're being made worse by climate change.

Pradeep Kakkattil, CEO,
Health Innovation Exchange

Six physical design adaptations

Rising temperatures, extreme weather events, disrupted power grids, and connectivity loss are no longer rare occurrences—they are becoming the norm in many regions. To ensure continuity, safety, and accessibility, digital tools must be engineered to withstand extreme weather conditions. Key considerations in designing digital tools for climate impacted regions should consider the following:



Thermal-Resilient Power Systems

Digital devices must operate reliably in both extreme heat and cold. In high-temperature environments where conventional batteries degrade quickly or fail altogether, high-temperature battery technology should be prioritized for deployment. In colder climates, cold-weather battery enhancements such as insulated casings and chemical formulations are essential to prevent freezing and maintain charge.



Solar and Off-Grid Power Integration

In many climate-affected regions, grid power is unreliable or unavailable. Digital technologies must be capable of operating independently through built-in solar panels for routers, sensors, and mobile devices. These solutions enable sustained operation in remote, off-grid, or disaster-stricken areas.



Modular and Repairable Design

Climate resilience also means long-term sustainability. Devices should be field-repairable, with components that can be replaced using locally available tools and parts. Modularity allows for upgrades or replacements of specific parts (e.g., batteries, sensors) without discarding the entire device. This reduces waste, lowers costs, and supports continuity in resource-constrained environments. Local infrastructure that supports repair should be created.



Waterproofing and Weatherproofing

Floods, humidity, and airborne particulates pose serious threats to digital hardware in coastal regions, flood zones, and areas with poor air quality. Devices must be physically protected from water ingress, dust, and humidity. Corrosion-resistant materials should be used to prevent degradation in saline or polluted environments.



Satellite and Mesh Connectivity

Connectivity is often the first casualty in climate emergencies. To maintain communication and data flow, devices should be satellite-enabled, leveraging LEO networks for global coverage. Mesh networking capabilities allow devices to form decentralized networks, ensuring local communication even when central infrastructure fails.



Adaptive Design

Intelligent devices combine adaptive software with environmental sensing to optimize performance in real time. Offline-first architecture ensures continuity without connectivity, while auto-adjusting modes respond to temperature, battery, or signal strength.

In addition to retrofitting digital tools for extreme weather conditions, leveraging technologies that can monitor and assess specific climate risks is crucial to prepare communities for climate shocks. For instance, incorporating AI into predictive modelling technologies enables more accurate disaster forecasting by analyzing local weather data and allowing users to fine-tune models based on what they want to track.

CASE STUDY

How Microsoft's Aurora strengthens disaster forecasting through adaptable design

The majority of Devex survey respondents (63%) identify predictive modelling as the top digital technology for mitigating the effects of climate change in the field of disaster resilience. By providing data-driven insights ahead of disasters, populations are better equipped to prepare for and respond to natural hazards.

Advancements in predictive modelling have significantly improved the accuracy and versatility of forecasting tools. Microsoft's Aurora, a large-scale deep learning AI model, is designed to predict global weather patterns and atmospheric processes such as air pollution. Using a foundation model, Aurora was first trained on large amounts of diverse weather and climate data to build general knowledge, which can then be fine-tuned for specific prediction tasks. This allows the tool to have a wider range of applications and provide predictive models for various types of hazards. Some of Aurora's use cases include:





Predicting Typhoon Doksuri's landfall in the Philippines four days in advance of the actual event. Researchers also found that Aurora outperformed seven major forecasting centers on all cyclone track forecasts for the 2022-2023 season globally.



Predicting air quality at a lower cost compared to traditional air quality forecasts. In 2022, Aurora accurately predicted the Iraq sandstorm a day in advance despite air quality data being relatively limited compared to weather data.



Predicting ocean wave details, including height and direction, by perceiving intricate wave patterns in greater detail. Aurora predicted oceanic events such as Typhoon Nanmadol in 2022, the most intense typhoon that year. Aurora also outperformed existing forecasts for wave activity in 86% of comparisons over an entire test year compared to current standards for predicting wave activity.

To help drive innovation in atmospheric forecasting, Microsoft has made Aurora's source code and model weights publicly available to allow developers to download and run, or build on the model. This demonstrates how adaptive design can make digital tools more accessible and scalable, allowing them to achieve greater impact at lower costs.

CASE STUDY

Incorporating AI solutions in technology design to bridge the gap in maternal and health services



Photo: Jacaranda Health

About half of pregnant people in low-resource settings do not receive ultrasound screenings during pregnancy, putting them at higher risk due to delays in diagnosis and treatment of potential complications. In Kenya, only 16% of mothers are able to access ultrasound services due to the high cost of traditional ultrasound machines. Additionally, traditional ultrasound machines rely on a continuous power source, leaving them vulnerable to power outages. While advancements in ultrasound devices have made them more accessible, the lack of trained healthcare workers who can operate them and read ultrasound images remains a problem in underserved communities.

To address this gap, Google has partnered with Jacaranda Health to help train AI models to interpret key health information from ultrasound images. Research has shown that AI readings are as accurate as trained ultrasonographers in determining key information, such as gestational age and fetal presentation. This allows nonexperts to conduct ultrasound screenings where traditional ultrasound services are inaccessible, increasing access to lifesaving services.

Integrating narrow AI, designed to perform specific tasks with high efficiency, can help maintain health services during climate disruptions when power outages and connectivity failures undermine delivery. Using this particular AI application, Google is similarly expanding access to health screening to address other diseases:



In partnership with Apollo Radiology International, Google has developed an AI system to read chest X-ray scans and identify early signs of tuberculosis. Under the partnership, Apollo will also use these models to provide up to 3 million free AI-powered screenings for TB, lung cancer, and breast cancer over the next 10 years.



Through the use of Google Lens, patients can take photos of any skin condition and use the tool to visually match the photo with similar skin conditions to aid in diagnosis and to help individuals seek treatment.

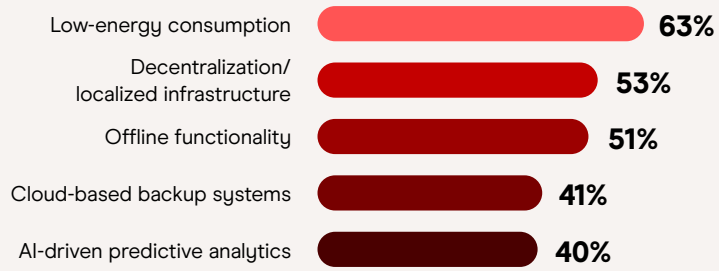


In partnership with Northwestern Medicine, Google has developed an AI system that integrates into breast cancer screening workflows to aid radiologists in the early detection of breast cancer.

These examples show how improvements in design using AI can expand access to critical services especially for underserved communities. Moreover, the use of localized, on-device AI models as opposed to cloud-based models could reduce energy consumption by 100 to 1,000 times per task, making them more suited to environments where access to electricity is limited. These advancements are particularly crucial in climate vulnerable communities where disasters hinder access to critical services for extended periods.

Designing digital tools with low power consumption or offline functionality can also improve digital programs in areas with frequent climate disruptions and limited infrastructure. Kiwix, a nonprofit organization, provides educational content from sources such as Wikipedia, Project Gutenberg, or TED Talks, which can then be downloaded and accessed on mobile devices without an internet connection. For Stéphane Coillet-Matillon, CEO of Kiwix, keeping the design simple is key to ensuring functionality even in the most challenging environments, and planning for resilience means focusing on the core necessities of the system. "Cloud services promise convenience, but the moment the connection breaks, you're left with nothing," he shares, adding that hosting educational content locally by design allows for uninterrupted access to learning materials, even in last-mile communities.

Top technological features for climate-resilient digital solutions



Source: Devex survey

"There's still work to be done to adapt technologies to emerging climate trends. There are key areas we need to focus on to make this possible. There's a need for further innovation, specifically climate tech innovations that can drive these technologies forward and help ensure they reach more people."

Karen Basiye, Safaricom Foundation



Leverage widespread technology for digital programs

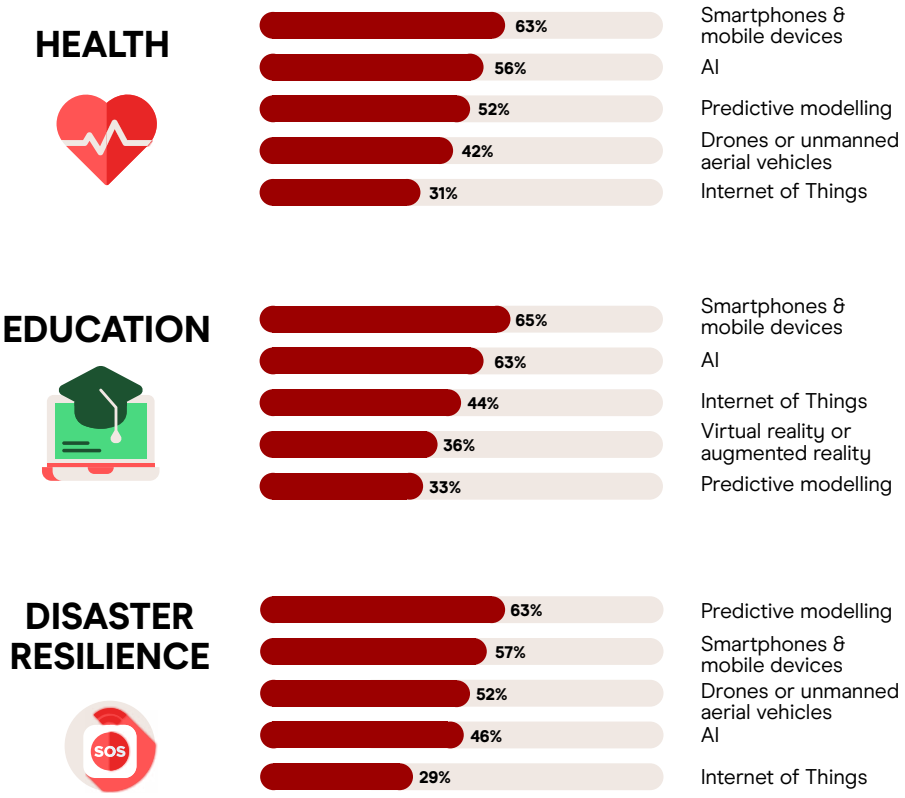
Designing digital solutions to withstand climate threats requires not only integrating technologies with climate-resilient features but also leveraging widely used tools in the community. Smartphones in particular present a significant opportunity to expand access to digital platforms and services.

Globally, 78% of individuals own some kind of mobile phone, and 90% live within range of at least a 4G signal. However, coverage does not guarantee access. Smartphone ownership and mobile broadband affordability remain major barriers, particularly in LMICs and climate-affected settings. While some functions can be delivered over 2G networks, the delivery of digital services increasingly depends on mobile broadband access and smartphone functionality.

Despite these limitations, mobile broadband is a driver of progress in health, education, and disaster response. Over 40% of mobile subscribers — about 2.4 billion people — use their devices to access training, learning materials, and health services. In emergencies, low-bandwidth tools such as cell broadcasts remain vital for rapidly reaching at-risk populations, especially in areas with limited smartphones or broadband access.

Additionally, survey respondents identify smartphones and mobile devices as a top digital tool for mitigating the effects of climate change on development outcomes across areas of health, education, and disaster resilience, showing the versatility of these tools in delivering services across different sectors. This demonstrates the importance of leveraging widely used technology to make digital development solutions both accessible and resilient, rather than introducing new technology for technology's sake.

Top digital technologies for mitigating the effects of climate change on development outcomes



"The future of warning systems is over your mobile phone, because 8 out of 10 people globally own a mobile phone and carry it with them most of the time. With the mobile phone, we have a siren system in our pockets, and we need to make sure that we use this opportunity to reach people at risk."

Vanessa Gray, ITU

CASE STUDY

The role of mobile communications in disaster response and resilience

Evidence shows that early warning systems provide a tenfold return on investment due to their ability to minimize casualties and damage from extreme weather events and disasters. However, U.N. data shows that a third of the world's population, mainly in least-developed countries and small island developing states, lack access to adequate multi-hazard early warning systems. These systems are essential for alerting individuals that hazardous weather or climate events are on the way while also informing governments, communities, and individuals on what to do in case of a climate event to help minimize its impact.

To address this gap, U.N. Secretary-General António Guterres launched the Early Warnings for All initiative in 2022. As part of this effort, ITU promotes the implementation of geo-located mobile early warning services using cell broadcast and location-based SMS. This allows governments to instantly reach millions of individuals for warning dissemination and communication through mobile phones. Warnings sent via cell broadcasts are also unaffected by mobile network congestion and can be customized for specific communities, including using the local language to disseminate information.

Apart from cell broadcasts, portable communications technology has also become invaluable for keeping communication lines open in disaster situations. The Vodafone Foundation's Instant Network Emergency Response initiative provides a range of technologies used in emergency situations including:

Instant Network: An ultra-portable global system for mobile communications, or GSM, network that provides 2G and 3G connectivity with inbuilt wireless capability and secure connectivity via firewall and VPN. The device packs into four cases weighing a total of less than 100 kilograms and can be set up in any location in under 40 minutes.



Instant Network Mini: An 11-kilogram mobile network in a backpack that provides a secure 2G GSM network. The GSM base transceiver station connects to a host network over a satellite connection and can provide up to five concurrent calls within a radius of 100 meters as well as enable text messages to thousands of people with crucial information following a disaster.

Instant Charge: A single box that, combined with a generator or another power source, has the capabilities to charge up to 66 phones simultaneously. Ideal for decongesting charging areas in emergencies, the device allows individuals to stay connected by providing a power source for those carrying mobile phones.

In 2025, Vodafone Foundation expanded the INER program to an additional 7 hubs to support local teams with rapid deployment during emergencies. Located in Albania, Czechia, DRC, Egypt, Ireland, Mozambique, and Portugal, the new hubs help improve localized preparedness for disasters and facilitate quicker, more cost-effective responses.

Regardless of the situation, the design of digital programs and tools should always seek to support existing technology and local groups who are already tackling challenges on the ground. Knowing and understanding the existing technologies and the features that make them resilient in any scenario will be key for achieving and sustaining program objectives.

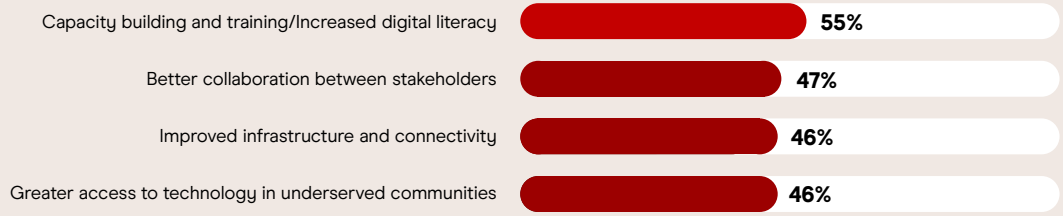
Challenge 3: Empowering through skills and locally relevant solutions



Digital transformation is only as effective as the capacity of people to use and shape it, with the sustainability of climate-resilient digital development tools hinging on the ability of the community to fully utilize them. Building digital and climate literacy, particularly among women, youth, and marginalized groups, is critical to not only be able to operate digital tools, but to also cocreate solutions that are better suited to local realities. This helps ensure that digital tools are not only technically sound but also culturally appropriate, linguistically accessible, and aligned with community priorities.

However, evidence suggests that there is a considerable digital skills gap in lower-income countries, contributing to a lack of buy-in of digital tools among community-level stakeholders. Digitally illiterate populations may have limited access to telemedicine, online education, or digitally delivered financial aid, and instead rely on intermediaries to interpret information or access services, which can slow down responses in time-sensitive situations.

Top enablers for the effective climate adaptation of digital tools and programs



Source: Devex survey

Provide capacity building and training for all stakeholders

Among Devex survey respondents, increasing digital literacy is seen as the top enabler for the effective adaptation of climate-resilient digital tools. The United Nations Environment Programme's 2024 Adaptation Gap Report notes that capacity building enhances participation by providing the skills needed to fully leverage technology. Closing the digital knowledge gap also fosters community ownership, allowing for sustained progress beyond the program duration.

To help develop digital skills in rural and underserved communities, ITU launched the Digital Transformation Centres Initiative in partnership with Cisco in 2019. The program focuses on delivering basic and intermediate digital skills training through a global network of 14 training institutions operating nationally. All training offered is free of charge for the learners. The initiative works with governments, the private sector, international organizations, and development agencies, as well as local stakeholders to implement internationally recognized training courses. Vanessa Gray, head of the Climate and Emergency Telecommunications Division, Telecommunication Development Bureau at ITU notes that the program is instrumental not only in addressing the digital skills gap, but also in addressing other barriers to digital access, including gender.

CASE STUDY

Addressing the gender-digital skills divide through DTCs

Despite the growing level of internet access around the world, the gap in digital skills prevents individuals from maximizing the use of digital tools. Gender inequality poses a significant threat to development outcomes as access to digital learning remains uneven. According to UNICEF data, adolescent girls and young women have a significantly lower prevalence of digital skills compared to their male counterparts. An analysis of 32 countries reveals that only 65 female youth have digital skills for every 100 male youth. This puts women and girls at greater risk, as digital technology continues to play an ever-increasing role in climate adaptation.

To address this gap, ITU and its partner organizations are providing digital skills training to girls through DTCs in various locations, including Morocco, the Côte d'Ivoire, Pakistan and Zambia. The courses provided include:

- **Basic digital literacy lessons** covering topics such as introduction to cybersecurity and digital awareness
- **Introduction to ICT careers** through a discussion on the opportunities and benefits of pursuing technological studies
- **Introduction on the use of the HP-Life platform**, which provides free digital courses to enhance business skills

Unlocking digital knowledge for those who need it most enables more individuals to benefit from digitally driven programs and supports inclusive progress toward the SDGs, ensuring that no one is left behind.

You can have access to the most amazing digital tools, but you also need to have the skills to fully take advantage of them. We're actively bringing these skills to those who need them most. We have DTCs where people learn about basic skills, as well as special initiatives for young women, because very often, women have less access and use of digital tools compared to men. We have special programs to make sure that women are aware of the opportunities in terms of building their skills. We monitor the different divides and then try to address them through very specific programs.

Vanessa Gray, ITU



Photo: ITU



Prioritize marginalized groups for cocreation of digital solutions

To make digital solutions more inclusive and accessible for climate-affected populations, Devex survey respondents place the most weight on strengthening digital literacy and skills. Building digital skills among the population, and especially marginalized groups, enables them to better engage with digitally enabled services. Empowering individuals through digital knowledge also creates a ripple effect that improves overall outcomes for individuals, including their ability to access economic opportunities, as well as health and education services.

We need to mobilize resources not only to bring new technologies to market, but also to ensure that existing tools are adopted where they're needed most. Too often, there's a focus on invention, but uptake is just as critical — especially in climate-vulnerable communities where technology must translate into real-world impact.

Roundtable participant

How to make digital solutions more inclusive and accessible for climate-affected populations

- Strengthen digital literacy and skills
- Enhance public accessibility and affordability of digital tools
- Foster active participation of the community in the design of digital solutions
- Design context-specific solutions
- Improve infrastructure and connectivity

Source: Devex survey

CASE STUDY

Innovation at UNHCR: Promoting ownership and sustainability through technical assistance and knowledge sharing

UNHCR's Innovation Service carries out an annual call for ideas to help identify the most pressing issues in displaced communities around the world. Its programs provide holistic support to UNHCR staff and refugee-led organizations, ensuring innovators have the knowledge, skills, and resources they need to bring lasting positive change to forcibly displaced and stateless communities.

In collaboration with ITU, GSMA, and the government of Luxembourg, the program supports Connectivity for Refugees, which aims to catalyze connectivity solutions from the field through research that provides a holistic understanding of the intersections of connectivity and displacement. The program employs a three-pillar approach to local innovation:



Field experimentation and support for the inclusion of displaced populations and hosting communities in strategic investments and frameworks.



Research on the availability of services and affordable access to meaningful internet connectivity.



Communications to provide legal pathways for refugees and displaced persons to access connectivity.

By adding technical assistance and knowledge sharing components to their programs, UNHCR is better able to identify the most pressing needs and codevelop solutions with the individuals most affected by these issues. This, in turn, fosters ownership of the solutions among refugees, ensuring sustained impact within their communities.

We receive roughly 3,000 ideas every year from refugee-led organizations and UNHCR teams across the world. We ask them to define their own challenges and propose solutions rather than imposing technologies ourselves. We then select the strongest ideas, provide funding, and offer technical support. Our next step is to build a system that gives problem-owners better access to existing solutions, so they can identify the most effective approaches to address their needs.

Hovig Etyemezian, UNHCR

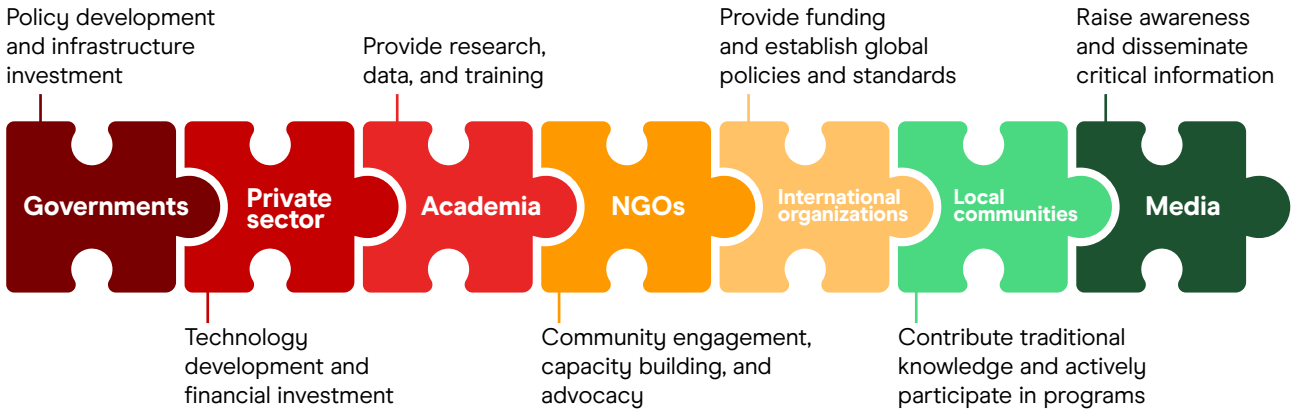
Beyond building skills in affected communities, enhancing digital literacy among governments, donors, and civil society partners is crucial to ensure the gains made through climate-resilient technology can be maximized and sustained. Knowledge sharing among all stakeholders — not just end users — is also critical for building skills and broadening awareness around digital solutions. The Declaration on Green Digital Action at the 29th U.N. Climate Change Conference highlights that facilitating knowledge exchange around best practices, including effective policy and technology applications, can ensure that digitally driven programs are replicated and adapted for diverse contexts.

Challenge 4: Fostering collaboration and innovation to strengthen digital development

As climate impacts grow more frequent and severe, stakeholders must collaborate to fully harness the potential of technology to adapt at pace. However, 8 out of 10 Devex survey respondents find that global development groups are not collaborating enough to support this adaptation. Without coordination, stakeholders often work in silos — duplicating efforts, competing for scarce resources, and missing opportunities to scale impact. For instance, when multiple climate-related early warning systems are developed independently, they often run parallel rather than in concert, resulting in fragmented coverage and confusion on the ground.

Survey respondents and interviewees emphasize that effective adaptation relies on the combined efforts of diverse groups: from the private sector's innovation and investment to academia's research to NGOs' community outreach and the media's role in raising awareness. Organizations such as ITU's Partner2Connect Digital Coalition, the GSMA and the Health Innovation Exchange, or HIEx, are already acting as conveners to connect stakeholders and spur innovation in their sectors, highlighting the importance of alignment around a common purpose to achieve greater impact. Strengthening these synergies will be crucial for addressing the ever-growing threat of climate change.

Effective adaptation of digital technologies for climate resilience requires collaboration among key stakeholders





CASE STUDY

Accelerating health innovation through cross-sector collaboration facilitated by the Health Innovation Exchange

A siloed approach to technology, where companies, governments, and development implementers build solutions independently, often lead to fragmented results. Neutral platforms that cultivate dialogue and partnerships among stakeholders can help bridge persistent gaps in funding, policy, and implementation.

The core challenge is that we all operate in our own comfortable verticals. There's little cross-sector dialogue, and international organizations aren't really enabling those conversations. Yet the most value lies in the intersections. Everyone has a role to play, but the architecture and language for collaboration are missing.

Pradeep Kakkattil, HIEx

HIEx was launched in 2019 on the sidelines of the World Health Assembly, or WHA, under the auspices of the Joint United Nations Programme on HIV/AIDS. The organization addresses the gap in healthcare access, working closely with health ministries to identify challenges, introduce relevant technologies, and facilitate access to financing to scale solutions — including those at the intersection of climate and health. "Climate became an opportunity to leverage and really rethink the way we deliver health care, the way we structure health systems," says HIEx CEO Pradeep Kakkattil. "Not treating climate in isolation but building a full system that supports countries, integrates necessary data systems, and fosters inter-ministerial collaboration."

The organization takes a three-pronged approach to accelerating access to innovative healthcare:

- **Convening:** Through high-level events at global forums such as the WHA and the UN General Assembly, HIEx facilitates strategic partnerships that help deploy impactful health technologies, particularly in underserved and climate-vulnerable regions in Asia and Africa.
- **Ecosystem building:** Through its Market Access Accelerator, HIEx supports growth-stage health innovators, offering advisory services, access to local partners, and a launchpad into international markets.
- **Investment acceleration:** HIEx supports long-term initiatives such as solar-powered health facilities, innovation funds, and public-private accelerators. In 2025 the organization launched a $500 climate and health investment fund with impact investing platform Symbiotics, complemented by a dedicated technical assistance facility to support portfolio companies, incubate new models, and connect entrepreneurs with investors.





Collaboration best practices

Engage the full ecosystem early: Involve governments, private sector, civil society, funders, academia, and local communities from the outset. Bringing these groups together early allows for codesign, better risk anticipation, and a greater chance to successfully scale.

Emphasize inclusivity: Ensure that the people most affected by climate change and digital transformation have a seat at the table.

Build cross-disciplinary understanding: Build climate literacy in health, education, and disaster response (and vice versa), and encourage joint training, interdisciplinary teams, and open access to data tools.

Strengthen government capacity and digital infrastructure: Support digital transformation efforts in public systems, especially in data sharing and governance, and address siloed data and weak infrastructure that limit real-time decision-making.

Create an enabling environment to support innovation

Creating an enabling environment that empowers different stakeholders to effectively play their roles in the digital development ecosystem is essential to achieve long-term, scalable impact. Adaptive technologies require a strong enabling environment to incubate, deploy and scale, and many regulatory and policy frameworks struggle to match the pace at which both climate stresses and technology evolve, particularly in LMICs. “These technologies have the potential to be transformative, but often stay stuck at the pilot stage,” says Dr. Ricardo Baptista Leite, CEO of HealthAI, the Global Agency for Responsible AI in Health. “The reasons are complex, but at the core most health systems aren’t set up to scale technology. In health, unlike other sectors, you need government and regulatory buy-in — and regulators are cautious about untested tools.”

The Devex survey reveals that government players are widely recognized as best positioned to lead this effort by shaping policy, guiding infrastructure development, and setting national priorities. UNEP’s Adaptation Gap Report finds that meeting global targets requires greater and more sustained support, including long-term investments in institutional capacity and governance systems essential for effective adaptation strategies. But many governments in LMICs need support in building regulatory frameworks that are agile, inclusive, and adapted to emerging technologies such as AI. To this end, organizations that act as convenors and facilitators help to bridge knowledge and capacity gaps to ensure that climate-resilient digital solutions are both safe and scalable.



CASE STUDY

Facilitating health technology regulation through HealthAI

As AI becomes increasingly integrated into health systems, ensuring that these emerging technologies are well-regulated is instrumental to developing, adapting, and scaling AI-enabled solutions to better withstand, and contribute less, to climate change.

HealthAI, the Global Agency for Responsible AI in Health, is a Geneva-based nonprofit established in 2019 to strengthen the governance and regulation of AI in health systems. Positioned at the intersection of AI, health policy, governance, and regulatory design, the organization serves as a bridge between global standards and local implementation, particularly among LMICs.

Working closely with governments, WHO, and health innovation stakeholders, HealthAI's mission revolves around building trust, catalyzing innovation, and centering equity in supporting the development and implementation of robust regulatory frameworks for integrating AI in health.

Key activities include:

- **Building and qualifying national and regional validation mechanisms for responsible AI use in health** in alignment with frameworks established by organizations such as WHO, OECD, and UNESCO.
- **Delivering advisory support on policies and regulations to countries**, helping them build governance systems and health technology assessment models that are necessary to responsibly scale AI in healthcare.
- **Establishing a global regulatory network for knowledge sharing and early warning systems**, to facilitate mutual learning, capacity building, and the sharing of best practices among a pioneer group of 10 countries.
- **Creating a global public directory of validated AI solutions for health**, enabling health authorities and investors to easily identify which AI technologies have been approved, by whom, and in what context, fostering greater transparency and informed decision-making.

In 2025, HealthAI created a community of practice where organizations can come together to discuss, share, and work to inform regulation. The platform brings together over 25 governments and over 280 institutions — from private sector innovators to civil society groups and academic partners — to foster collaboration between stakeholders.

Explore innovative financing approaches to tackle resource scarcity

When it comes to financing the development and use of climate-resilient digital tools, traditional instruments alone will be insufficient to fill the investment gap. Despite an upward trend in climate adaptation finance, UNEP estimates a funding shortfall reaching between $187 billion and $359 billion. At the same time, in 2024, against the backdrop of escalating crises and shrinking development budgets, official development assistance declined for the first time in six years. Other shifts in foreign policy — including the sudden dismantling of the United States Agency for International Development, the US withdrawal of $4 billion in pledged financing to the Green Climate Fund, and announcements to cut 40% of UK aid — have culminated in a moment of reckoning for the development community to reexamine longstanding approaches to address persistent development challenges.

Devex experts believe that the strain on traditional aid underscores both the need for stronger high-level coordination, as well as restructuring the investment ecosystem to attract and align a broader range of actors to meet funding demands. For example, private companies, especially in the tech sector, can play a catalytic role by investing early, codeveloping models, and helping solutions scale. UNEP also notes that bridging climate adaptation gaps requires a reimagining of funding approaches that incorporate innovative finance mechanisms and private sector expertise. However, "while the private sector may have an important role to play, it's not a panacea for the financing challenges," emphasizes Sarah Beardmore.

No one expects the private sector to fill the entire funding gap, as it's just one part of the solution. But this moment also opens up space to think about different models of collaboration. For example, what might it look like to take more market-based approaches within a country, not just through corporate philanthropy, but through social enterprises or other market-driven strategies that support development outcomes? How can new technology enable this?"

Brigitte Gosselink, Google

Innovative financing mechanisms for climate-resilient digital infrastructure

Financing the climate adaptation of digital infrastructure calls for a coordinated shift to more innovative funding models. Some examples include:

- **Blended finance models** that combine grants, concessional loans, private investment, and philanthropic support to de-risk early innovation.
- **Coinvestment models** between public and private actors to help share risk and strengthen ownership, while investing in shared infrastructure and digital public goods reduces duplication and broadens impact.
- **Impact investing and outcome-based financing** to further align financial returns with resilience goals.
- **Incentive mechanisms**, such as climate-linked reimbursements or performance-based subsidies, to drive the adaptation of climate-smart solutions.

Coordination is key. Different donors are prioritizing various aspects of health and its connection to climate impacts. We work with a range of donors – including governments and private sector actors, such as large corporate foundations. What's needed is a mixed-model approach that encourages coinvestment, cooperation, and coordination around shared funding priorities. These priorities could then be applied at global or regional levels. That kind of concerted collaboration is essential.

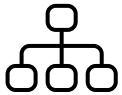
Heidi Good, PATH

CASE STUDY

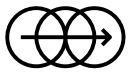
Bridging the digital financing gap through collective ownership and action via the Digital Infrastructure Investment Initiative

Digital networks underpin services such as disaster warning systems, remote education, and health service delivery in climate-vulnerable settings. Strengthening this backbone is a climate resilience multiplier, with cascading benefits across sectors and communities — but bridging financing gaps at scale requires persistent, high-level coordination.

Launched in 2024 in coordination with Brazil's G20 presidency, the Digital Infrastructure Investment Initiative, or DIII, was developed by the ITU in partnership with major development finance institutions, or DFIs, including the World Bank Group, European Bank for Reconstruction and Development, African Development Bank, Asian Infrastructure Investment Bank, Inter-American Development Bank, and Islamic Development Bank. DIII focuses on mobilizing investment in critical hardware infrastructure, such as mobile and fixed broadband, data centers, undersea cables, internet exchange points, and towers. Its core strategies include:



A country assessment framework that helps identify policy, investment, and regulatory barriers to digital infrastructure deployment.



Mapping and promoting innovative finance instruments, including blended finance models and de-risking mechanisms to attract private capital.



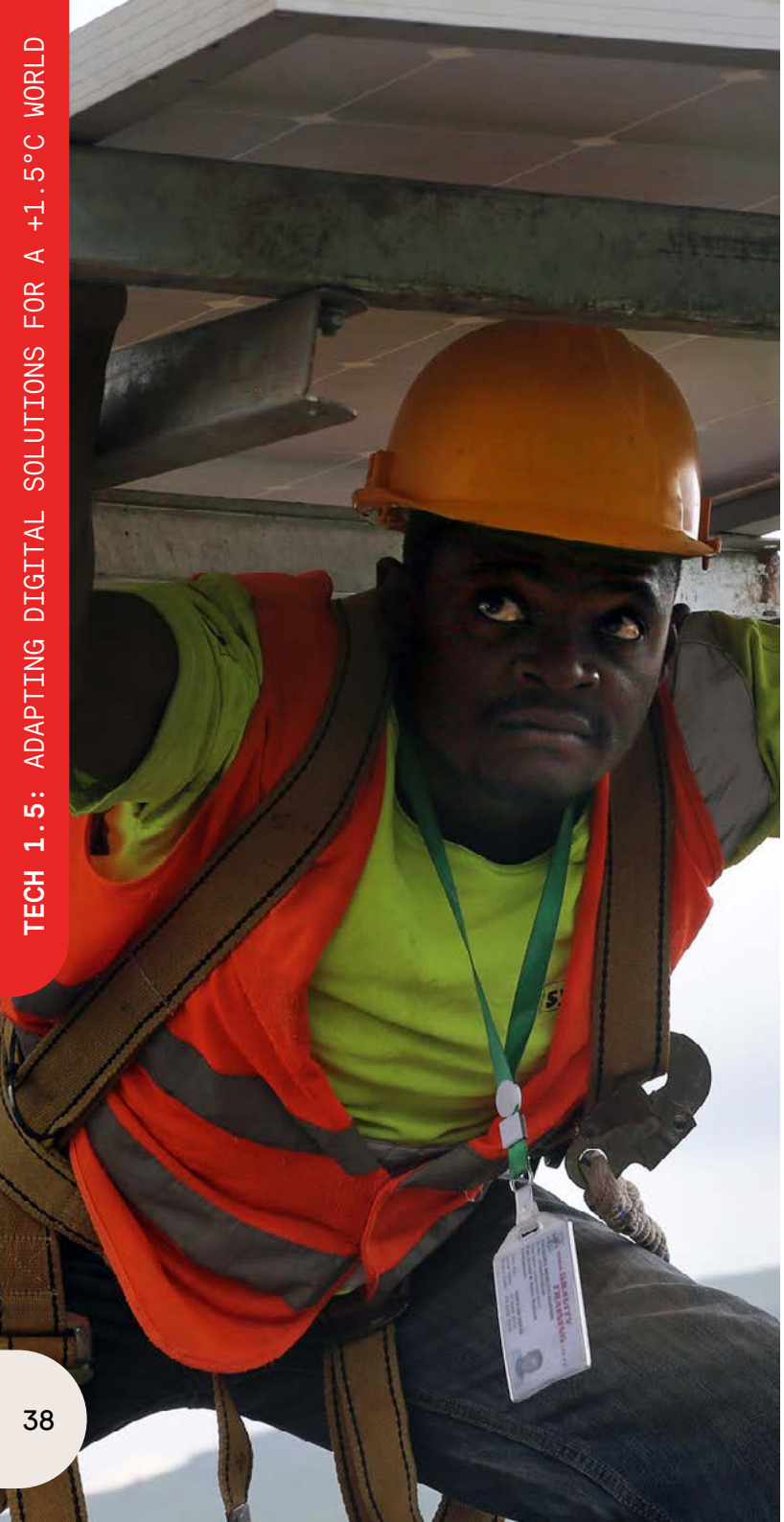
Producing a 2025 white paper that quantified the global investment gap and identifies priority intervention areas.

The initiative is also anchored at key international forums and is endorsed by the G20 Digital Economy Working Group and linked to the UN Summit of the Future and the 2025 UN Financing for Development Conference.

By convening governments, multilateral banks, industry players, and infrastructure developers in a shared working group, DIII aligns innovative finance and multilateral leadership to build a sustainable foundation for digital climate resilience. ITU's Partner2Connect platform, which complements the DIII, has generated $73 billion in connectivity pledges, demonstrating strong political and financial momentum.



Photo: ITU



DFIs also play a pivotal role when it comes to filling financing gaps by de-risking investments, strengthening local financial markets, and codeveloping blended finance pipelines. For instance, as the UK's DFI, the British International Investment, or BII, focuses on impact investments in Africa, Asia, and the Caribbean. As part of its commitment to sustainability, BII integrates climate impact scoring directly into its investment processes. Proposals receive additional weight for contributing to mitigation, adaptation, or resilience, helping climate-positive investments rise to the top. "One of the biggest challenges in climate finance is that these projects often lack proven business models," says Abhinav Sinha, managing director and head of technologies, telecoms, and sustainable industrials at BII. "Many DFIs and agencies, especially those investing public funds, tend to avoid startup risk, and our system helps counterbalance that hesitation and push investment toward climate innovation."

Determining which kinds of innovations to invest in is a common question among development groups. Sinha notes that the complexity of climate change requires system-wide solutions, which emerging technologies, such as AI, are well-positioned to deliver. "AI can optimize materials, supply chains, and more, but we need to focus on local use cases using small, efficient models rather than general-purpose large language models," he says. But while developing new tools that can better withstand the effects of climate change is seen as an important area of investment, funding the strengthening of existing technology is likewise fundamental. "As funders, we need to invest more in maintaining digital tools that have already proven effective," says Wellcome's Felipe J Colón-González, adding, "Too often, funding priorities focus on the next shiny thing. Once a new tool is rolled out, it's quickly forgotten as attention shifts elsewhere. But many of these tools were designed for a clear purpose and have delivered results, yet they lack long-term funding for continued use."

It's important to focus on the problem first – what's fit for purpose, what core infrastructure is needed, and what data is essential. Technology will keep evolving, but with strong connectivity, solid infrastructure, and trusted datasets, we'll be ready to harness new innovations over time.

Seth Ayers, World Bank



Blueprint for action

Climate change's ability to undermine digital tools and programs compromises development outcomes across health, education, and disaster resilience, demanding a new approach to how digitally driven development solutions are designed, deployed, and sustained.

The blueprint for action sets out four strategic actions to ensure that digital development programs are ready for the future. It is grounded in evidence from experts and designed for impact, and outlines clear roles for government institutions, tech companies, foundations, and NGOs, driven by the leadership of communities.

This blueprint calls for bold investment in inclusive infrastructure to withstand climate shocks and bridge connectivity gaps. It prioritizes technologies designed for climate extremes that work in low-connectivity and off-grid environments, ensuring access even in the most disrupted settings. It focuses on equipping communities with digital and climate literacy and cocreating locally relevant solutions that reflect real needs. It demands ethical, sustainable digital practices, including strong data governance and long-term support. Finally, it champions cross-sector collaboration and innovative financing to scale solutions that are interoperable, inclusive, and built to last.

Tech 1.5: Blueprint for climate-resilient digital development



1 Expanding inclusive and resilient infrastructure



2 Designing climate-resilient digital tools that respond to local needs and climate threats



3 Empowering through skills and locally relevant solutions



4 Fostering collaboration and innovation to strengthen digital development

1. Expanding Inclusive and Resilient Infrastructure

Underserved communities continue to struggle with the lack of connectivity and access to energy, while climate-related events, which are increasing in frequency and intensity threaten even the most developed countries around the world.

ACTION POINT 1A **Invest in robust digital and energy infrastructure and promote open standards.**

EVIDENCE **Respondents identify infrastructure damage (69%) and connectivity loss (65%) as the top climate-related factors affecting digital programs.**

HOW IT CAN BE ACHIEVED

- **Governments** must embed infrastructure development into national climate and digital strategies, prioritizing underserved and climate-vulnerable regions.
- **Tech companies** should coinvest in infrastructure where there is low opportunity for a return on investment, or ROI, through public-private partnerships and ensure their technologies align with open standards.
- **Foundations** can provide catalytic funding for infrastructure pilots and scale-up, particularly in fragile or remote areas.
- **NGOs** should lead needs assessments and advocate for climate-smart and inclusive infrastructure planning.
- **Communities** play a vital role in identifying local infrastructure gaps, maintaining systems, and ensuring that infrastructure investments reflect real-world needs and usage patterns by providing feedback.

ACTION POINT 1B **Prioritize digital tools that function offline, consume low energy, and are suitable for areas with limited connectivity or power access.**

EVIDENCE **Respondents emphasize the importance of low-energy consumption (63%) and offline functionality (51%) as essential features for climate-resilient digital solutions.**

HOW IT CAN BE ACHIEVED

- **Governments** should incentivize the development and deployment of low-bandwidth, energy-efficient technologies through procurement policies and innovation grants.
- **Tech companies** must design and distribute tools optimized for low-resource settings, including solar-powered devices and offline-first platforms.
- **Foundations** can support research and development for innovation and fund deployments in low-connectivity environments.
- **NGOs** should pilot and adapt these technologies in operational settings.
- **Communities** are essential for testing and validating these technologies, providing feedback on usability, and ensuring adoption in real-world conditions.

2. Designing climate-resilient digital tools that respond to local needs and climate threats

Digital technologies are as varied as the challenges faced by communities around the world, and some tools work better in certain contexts than others.

ACTION POINT 2A

Tailor digital tools to local needs and infrastructure realities when planning and implementing digital solutions.

EVIDENCE

Low-energy consumption (63%), decentralization and localized infrastructure (53%), and offline functionality (51%) emerged as the most critical features for climate-resilient digital solutions, reinforcing the need to design tools that reflect local conditions and infrastructure constraints.

HOW IT CAN BE ACHIEVED

- **Governments** should prioritize investment in resilient digital infrastructure and expand affordable connectivity.
- **Tech companies** must partner with local providers to ensure accessibility and develop low-bandwidth tools.
- **Foundations** can fund community-led innovations and capacity building initiatives.
- **NGOs** must facilitate participatory design processes and implement digital literacy programs.
- **Communities** should actively engage in codesign of programs and sustain local adoption of digital solutions.



ACTION POINT 2B

Design and deploy digital technologies with physical resilience to climate extremes.

EVIDENCE

Respondents cite infrastructure damage and connectivity loss as major climate-related threats to digital programs. Other climate-related disruptions such as population displacement (55%) and supply chain issues (55%) further highlight the need for durable, adaptable hardware. Key features include high-temperature batteries, waterproofing, solar integration, satellite connectivity, and modular, repairable design.

HOW IT CAN BE ACHIEVED

- **Governments** must set climate-resilient hardware standards and incentivize innovation through procurement and regulation.
- **Tech companies** should invest in research and development for durable, modular, and repairable devices suited to extreme environments and local climates.
- **Foundations** can fund pilot deployments and support open innovation in climate-resilient tech design.
- **NGOs** should test and validate hardware in field conditions, and advocate for inclusive access to resilient technologies.
- **Communities** should provide feedback on usability, maintain devices locally, and inform design based on real-life experience.

3. Empowering through skills and locally relevant solutions

All stakeholders must be equipped with adequate digital skills and literacy to make the most of digitally driven programs.

ACTION POINT 3A

Deliver digital and climate literacy training, especially for women and youth, and cocreate tools with end users.

EVIDENCE

Respondents identify capacity building and training (55%) as the top enabler for effective adaptation of digital tools for mitigating the effects of climate change on development outcomes. Technologies such as smartphones and other mobile devices, and AI are widely used, but their success depends on digital skills and locally tailored design.

HOW IT CAN BE ACHIEVED

- **Governments** should integrate digital and climate literacy into national education and workforce development programs.
- **Tech companies** can support training hubs and mentorship programs.
- **Foundations** should fund inclusive capacity-building initiatives and participatory design processes.
- **NGOs** must lead training efforts and facilitate codesign workshops.
- **Communities** should actively participate in training programs and cocreation processes, ensuring that tools reflect local languages, customs, and priorities.



4. Fostering collaboration, innovation, and scalable impact

Organizations working to fight climate change cannot work in silos. Every aspect, from policymaking to financing, and from program planning to implementation, needs to be done collaboratively.

ACTION POINT 4A

Encourage cross-sector collaboration, inclusive policy-making, and innovative financing to scale digital solutions for climate resilience.

EVIDENCE

Technologies such as predictive modelling, IoT, and drones are used across sectors and require interoperability and scalable partnerships to operate properly. Yet 81% of survey respondents believe that global development partners are not collaborating enough to facilitate the adaptation of digital technologies to better mitigate the effects of climate change.

HOW IT CAN BE ACHIEVED

- **Governments** should convene multi-stakeholder platforms and align climate, digital, and development policies.
- **Tech companies** must collaborate with NGOs and governments to scale innovations and share data responsibly.
- **Foundations** can act as conveners and funders of cross-sector initiatives.
- **NGOs** should facilitate knowledge exchange and build bridges between operational actors and policy frameworks.
- **Communities** should be engaged as innovation partners, contributing local knowledge, testing solutions, and helping scale what works.

ACTION POINT 4B

Establish strong data governance, ensure ethical use of AI, and allocate resources for long-term maintenance and support of digital tools.

EVIDENCE

Survey respondents identify AI and predictive modelling among the top technologies to mitigate climate change across sectors. The use of cloud-based backup systems (41%) and AI-driven analytics (40%) as features of climate-resilient digital solutions highlights the need for ethical, secure, and sustainable digital practices across sectors.

HOW IT CAN BE ACHIEVED

- **Governments** must enforce robust data protection laws and ethical AI frameworks.
- **Tech companies** should commit to transparent data practices and long-term support for deployed technologies.
- **Foundations** can fund lifecycle maintenance and independent audits.
- **NGOs** should monitor digital rights and advocate for responsible technology use.
- **Communities** must be informed and empowered to understand how their data is used, demand transparency, and contribute to ethical oversight.

Matrix of Stakeholder Roles

Key Challenge	Action Points	Stakeholder Type				
		Government	Tech companies	Foundations	NGOs	Communities
1. Expanding inclusive and resilient infrastructure	1a. Invest in robust digital and energy infrastructure and promote open standards.	Embed infrastructure development into national climate and digital strategies, prioritizing underserved and climate-vulnerable regions.	Coinvest in infrastructure where there is low opportunity for ROI through public-private partnerships and ensure their technologies align with open standards.	Fund infrastructure pilots and scale-up, particularly in fragile or remote areas.	Lead needs assessment efforts and advocate for climate-smart and inclusive infrastructure planning.	Identify local infrastructure gaps, maintain systems, and ensure that infrastructure investments reflect real-world needs and usage patterns by providing feedback.
	1b. Prioritize digital tools that function offline, consume low energy, and are suitable for areas with limited connectivity or power access.	Incentivize the wdevelopment and deployment of low-bandwidth, energy-efficient technologies through procurement policies and innovation grants.	Design and distribute tools optimized for low-resource settings, including solar-powered devices and offline-first platforms.	Support R&D for innovation and fund deployments in low-connectivity environments.	Pilot and adapt technologies in operational settings.	Test and validate technologies, provide feedback on usability, and ensure adoption in real-world conditions.
2. Designing climate-resilient digital tools that respond to local needs and climate threats	2a. Tailor digital tools to local needs and infrastructure realities when planning and implementing digital solutions.	Prioritize investment in resilient digital infrastructure and expand affordable connectivity.	Partner with local providers to ensure accessibility and develop low-bandwidth tools.	Fund community-led innovations and capacity building initiatives.	Facilitate participatory design processes and implement digital literacy programs.	Engage in codesign of programs and sustain local adoption of digital solutions.
	2b. Design and deploy digital technologies with physical resilience to climate extremes.	Set climate-resilient hardware standards and incentivize innovation through procurement and regulation.	Invest in R&D for durable, modular, and repairable devices suited to extreme environments and local climates.	Fund pilot deployments and support open innovation in climate-resilient tech design.	Test and validate hardware in field conditions, and advocate for inclusive access to resilient technologies.	Provide feedback on usability, maintain devices locally, and inform design based on real-life experience
3. Empowering through skills and locally-relevant solutions	3a. Deliver digital and climate literacy training, especially for women and youth, and cocreate tools with end users.	Integrate digital and climate literacy into national education and workforce development programs.	Support training hubs and mentorship programs.	Fund inclusive capacity-building initiatives and participatory design processes.	Lead training efforts and facilitate codesign workshops.	Participate in training programs and cocreation processes, ensuring that tools reflect local languages, customs, and priorities.
4. Fostering collaboration and innovation to strengthen digital development	4a. Encourage cross-sector collaboration, inclusive policy-making, and innovative financing to scale digital solutions for climate resilience.	Convene multistakeholder platforms and align climate, digital, and development policies.	Collaborate with NGOs and governments to scale innovations and share data responsibly.	Act as conveners and funders of cross-sector initiatives.	Facilitate knowledge exchange and build bridges between operational partners and policy frameworks.	Engage as innovation partners, contributing local knowledge, testing solutions, and helping scale what works.
	4b. Establish strong data governance, ensure ethical use of AI, and allocate resources for long-term maintenance and support of digital tools.	Enforce robust data protection laws and ethical AI frameworks.	Commit to transparent data practices and long-term support for deployed technologies.	Fund lifecycle maintenance and independent audits.	Monitor digital rights and advocate for responsible technology use.	Be informed and empowered to understand how their data is used, demand transparency, and contribute to ethical oversight.

Conclusion

With 2015-2024 announced as the ten warmest years on record, climate change is no longer a distant threat but a present and escalating reality that is reshaping the context in which digital development operates. As this report has shown, the success of digital tools in sectors such as health, education, and disaster response now depends on their ability to adapt to a world increasingly defined by disruption. From floods disabling critical infrastructure to heatwaves overwhelming energy grids, climate impacts are directly undermining the promise of digital transformation.

Yet the findings also make clear that we are faced with a pivotal opportunity. With the right investments, policies, and partnerships, digital systems can be redesigned not only to survive in a warming world, but to serve as critical enablers of climate-ready development. This will require closing persistent infrastructure and skills gaps, meaningfully involving local communities in the design and deployment of digital tools, and improving coordination across stakeholders.

The path forward is clear: Digital solutions must be reimagined to be more inclusive, resilient, and responsive so that communities can not only endure the climate crisis but also shape a more secure and equitable future. By incorporating climate resilience as a core principle of digital development, stakeholders can take bold, collective action to equip communities with the proper tools in the face of accelerating change.



Photo: Carl Kho / Unsplash

List of Abbreviations

AI	Artificial intelligence
BII	British International Investment
DFI	Development finance institution
DIII	Digital Infrastructure Investment Initiative
DTC	Digital Transformation Centres
GSM	Global System for Mobile Communications
HIEx	Health Innovation Exchange
ICT	Information and communication technology
IDMC	Internal Displacement Monitoring Centre
IoT	Internet of things
INS	Instant Network Schools
ITU	International Telecommunication Union
LEO	Low Earth orbit
LMICs	Low- and middle-income countries
SDGs	Sustainable Development Goals
UN	United Nations
UNEP	United Nations Environment Programme
UNHCR	UN Refugee Agency
UNICEF	United Nations Children's Fund
WHA	World Health Assembly
WHO	World Health Organization

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